



Service Bulletin

Title: **RMX Turn-on Delay**
Bulletin #: RMX0002 Issue Date: September 28, 2000
Models Affected: RMX 850, 1450 & 2450 Bulletin Revision: A
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Description

Some RMX Series amplifiers take longer than 10 seconds to fully turn on. This is caused by the 5.6-volt zener diodes (D107, D110, D207, and D210) in the bias circuitry causing the op amps to remain in non-symmetrical cutback even after turn-on muting ends. The channel bias will take perhaps 10 to 30 seconds to set before the amplifier begins working normally.

This bulletin describes a corrective procedure that involves replacing the original zeners with 4.7-volt diodes and 180 Ω resistors to improve op-amp turn-on.

Symptoms

After the amplifier is turned on, both channels' clip LEDs remain lit for more than 10 seconds. This occurs only when speaker loads are attached to the amplifier outputs.

Instructions

Tools and materials required:

- Soldering iron with fine tip (recommended range 25 to 60 W)
- Rosin-core solder (60/40 or 63/37 eutectic type)
- Long-nose pliers
- #1 and #2 Philips screwdrivers
- Small diagonal cutters
- Desoldering equipment or solder braid
- Four 4.7V zener diodes (QSC part # QD-0004.7-ZT) and four 180 Ω ¼W 5% resistors per RMX amplifier

Test equipment required:

- Oscilloscope
- 2-ohm resistive load (rated for at least 1200 watts)
- Shorting connector for amplifier output
- Variable AC transformer (e.g., Variac, Powerstat, etc.) rated for 25A (120V) or 12A (230V). Make sure the amplifier and your AC supply are compatible.
- 1 kHz audio sine wave generator
- Digital multimeter
- Digital current meter (e.g., Fluke 30 Clamp Meter)
- Trimpot adjustment tool (non-conductive)

Procedure: replacing the zener diodes

The RMX 850 and RMX 1450 use single-sided printed circuit boards, so replacing the zener diodes requires removal of the two channel module boards from the chassis. The RMX 2450 uses double-sided boards with plated-through holes, so zener replacement can be done while working from the top side of the board, and removing the channel modules is unnecessary.

Preliminary work

1. Disconnect the amplifier from the AC service and wait several minutes to let internal voltages bleed down.
2. Remove the top cover.

RMX 2450

1. Locate diodes D107 and D110. See Figure 1.
2. With the diagonal cutters, clip out the body of the diodes.

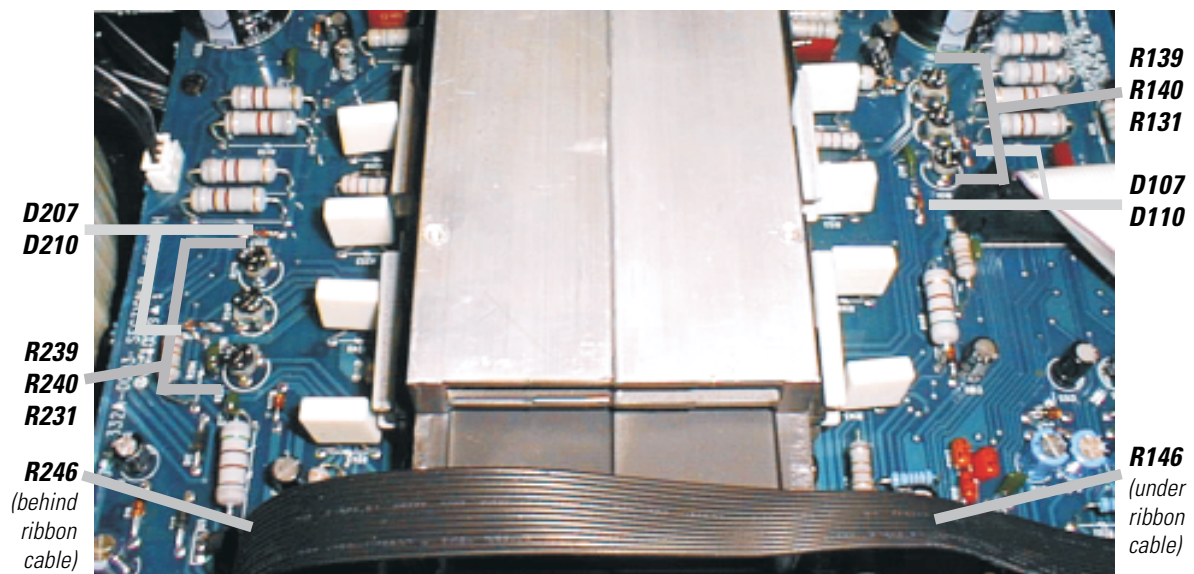


Figure 1. Components D107, D110, R131, R139, R140, R146, D207, D210, R231, R239, R240, and R246 in the RMX 2450. Note that in this model, the positions of channel 1 and 2's channel modules are the reverse of where they are in the RMX 850 and RMX 1450.

3. With long-nose pliers, hold one of the lead remnants. Melt the solder with the iron, then pull the lead out of the circuit board. Use braid or desoldering equipment to remove excess solder from the hole. Repeat for the three other lead remnants.
4. Twist the anode lead of a new 4.7-volt zener diode with one lead of a 180 Ω resistor to form a "V" and solder them together; trim the excess. Then trim the cathode lead and the other resistor lead so they fit into place on the board without short-circuiting anything. Repeat for the other three diodes and resistors. See Figure 3.
5. Insert the zener/resistor combinations. Pay attention to their correct orientation: the cathode (the banded end) of D107 should point toward the front of the amp, while the cathode on D110 should point to the back. Solder them in place (Figure 3).
6. Repeat for diodes D207 and D210. D207's cathode should point away from the heat sink, while D210's should point toward it.
7. Continue with bias and current limiting adjustments.

RMX 850 and RMX 1450

1. At the front panel, pull the two gain control knobs straight off.
2. Underneath the amplifier, remove the four screws that secure the heat sinks to the chassis.
3. Remove the eleven screws that fasten the two channel modules to the chassis (six screws on channel 1's module, and five on channel 2's).
4. Detach the input ribbon cable from channel 2's module.
5. At the front of the channel module boards and in front of the heat sink tunnel, disconnect one end of the ribbon cable that connects between the two channel modules.
6. On the rear panel, loosen the four screws on the fan enough to allow you to remove the fan shroud (Figure 2). Lift the shroud straight up to remove.
7. Slide the two channel module boards straight back to clear the LEDs and gain control shafts of their chassis front panel openings. Lift the boards up to gain access to the undersides.
8. Locate diodes 107 and 110 (Figure 4). Unsolder and remove them from the board.

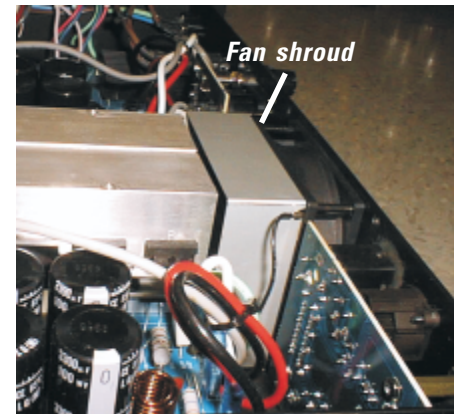


Figure 2. Removing the fan shroud makes it easier to remove the channel module boards on the RMX 850 and RMX 1450

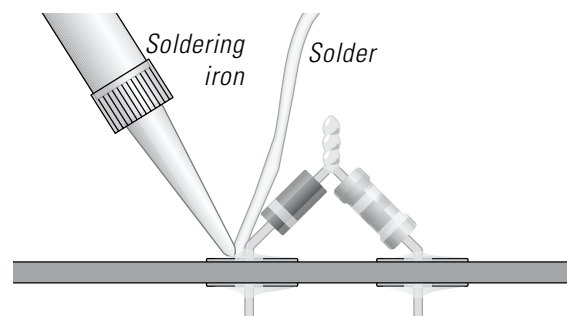


Figure 3. Soldering the zener diode and resistor to the circuit board. On the RMX 2450, the components can be soldered on the top side of the board as shown; on the RMX 850 and 1450, they are soldered on the underside.

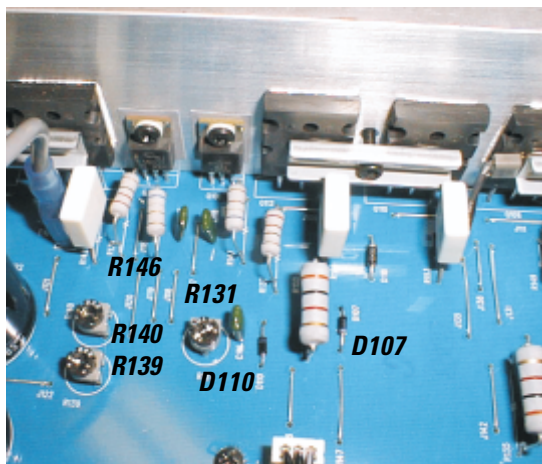


Figure 4. D107, D110, R131, R139, R140, and R146. The components for channel 2 are similarly located on the other channel module. The model shown is an RMX 1450, but the RMX 850's components are located in the same places.

4. Twist the anode lead of a new 4.7-volt zener diode with one lead of a 180 Ω resistor to form a "V" and solder them together; trim the excess. Repeat for the other three diodes and resistors. See Figure 3.
9. Insert the diode/resistor combinations into the circuit board. Make sure they are correctly oriented: the cathode (the banded end) of D107 should be on the diode end pointing away from the heat sink, while on D110 the cathode should be on the end closer to the heat sink.
10. Solder the diode and resistors to the circuit board. Trim off the excess leads.
11. Repeat for diodes D207 and D210.
12. Re-assemble the channel modules into the chassis. Remember to re-attach the small ground wire from the fan shroud to the nearest mounting screw on channel 2's module. Reconnect the input ribbon cable as well as the short ribbon cable that joins the two modules.
13. Continue with bias and current limiting adjustments.

Procedure: bias and current-limiting calibration

Note: During the current-limiting part of this procedure, the amplifier will draw high amounts of AC: approximately 22 amperes at 120V, or 11 amperes at 230V. Be thorough, but work quickly to avoid tripping the amplifier's circuit breaker.

1. Start with the variable transformer turned all the way down to zero and the amplifier turned off and its top cover still removed.
2. On the amplifier's circuit boards, locate resistors R146 and R246, and trimpots R131, R231, R139, R239, R140, and R240 (Figures 1 and 4).
3. Plug the amplifier into the transformer.
4. Turn the gain controls all the way down.
5. Turn the amplifier on and gradually turn up the transformer to the amplifier's normal operating voltage, while monitoring its AC current draw. Make sure the amplifier is functioning correctly.

Table 1

Calibrations	Adjust	RMX 850	RMX 1450	RMX 2450
Channel 1 bias: DC voltage across R146	R131	0.16 V	0.14 V	0.09 V
Channel 2 bias: DC voltage across R246	R231	0.16 V	0.14 V	0.09 V
Output current into shorted load	Channel 1: R139 & R140 Channel 2: R239 & R240	4–4.5 A	4–5 A	8–9 A
AC current when driving shorted load*	Channel 1: R139 & R140 Channel 2: R239 & R240	3.75–4.5 A	4.5–5.5 A	5–6.5 A
Clipping voltage into 2 ohms (RMS)	Channel 1: Adjust R139 for symmetry Channel 2: Adjust R239 for symmetry	26–29 V	33.5–37.5 V	44–49 V
Clipping voltage into 2 ohms (peak)	Channel 1: Adjust R139 for symmetry Channel 2: Adjust R239 for symmetry	36.8–41 V	47.4–53 V	62.2–69.3 V
Idle AC demand* (at ambient temperature; higher when hot)		0.4 A, $\pm 10\%$	0.4 A, $\pm 10\%$	0.5 A, $\pm 10\%$

*Figures shown are for 120V amplifiers; multiply current by 0.5 for 230V.

Bias adjustment (perform only with unit at ambient temperature)

Note: This calibration must be done with the amplifier circuitry at ambient temperature. If the amp has begun to warm up, you must turn it off and wait until it cools down.

6. Measure the DC voltage across R146. Adjust bias trimpot R131 to reach the correct voltage shown in Table 1.
7. Next, measure the DC voltage across R246. Adjust bias trimpot R231 to reach the correct voltage shown in Table 1.

Current limit adjustment

8. Set the audio sine generator to 1 kHz at 1 volt RMS and connect it to channel 1's input. Connect channel 1's output to a 2-ohm load, and connect the oscilloscope probe across channel 1's output.
9. Turn up channel 1's gain control partway. On the oscilloscope you should see the amplitude of the sine wave increase accordingly.
10. Turn the gain control back down and apply a short circuit across the output terminals of channel 1. Clamp a current probe either onto one of the brown wires running to the AC switch or onto the gray output wire from channel 1's module.
11. Turn the gain control all the way up. Adjust trimpots R139 and R140 equally until the current measured falls within the range shown in Table 1.
12. Turn the gain control all the way down and remove the short circuit so the channel drives the 2-ohm load. Turn the gain control back up until the output clips. The voltage at which the signal starts to clip should fall within the range shown in Table 1. If the clipping is asymmetrical, that is, the signal clips on either the positive or negative side first, adjust R139 to make it symmetrical.
13. Turn the gain control down. If the amp has begun to warm up shut it off and let it cool a few minutes before proceeding with channel 2.
14. Repeat steps 8 through 12 for channel 2. Use trimpots R239 and R240 to adjust the current limiting in steps 11 and 12.
15. Turn both channels' gain controls all the way down. Clamp the ammeter onto one of the amp's AC wires and check the amp's idle current. If the amplifier is still at about room temperature, the idle current should match the value shown in Table 1.

Procedure: finishing the repair

1. Turn the amp off and disconnect all cables.
2. Re-install the top cover. The amplifier may now be returned to use.

Contact information

If you need any further information regarding this service procedure, please contact QSC Technical Services at the addresses or numbers below.

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